METHOD OF REPORTING CHANNEL STATE INFORMATION

FIELD OF INVENTION

[0001] The present invention relates to a method of reporting channel state information from a network element of a communication network. In particular the communication network may be a mobile communication network. Furthermore, the invention relates to a network element, a method of obtaining channel state information, and a communication network. Additionally, it relates to a program element and a computer readable medium.

ART BACKGROUND

[0002] The field of invention is mobile radio system concepts or communication network system concepts like 3GPP LTE, LTE-A and its evolution and especially future optimizations for relaying, i.e. the use of relay nodes (RN) additionally to base stations in order to improve the performance of communication network. Relaying as such has been standardized already for LTE Release 10. In the EU funded project ARTIST4G advanced relaying is investigated and specifically cooperative backhauling for the Donor enhanced nodeB (DeNB) to RN links. The motivation is that these backhaul links define predominantly the RN performance, especially with respect to the achievable capacity gains, which are expected to be significant in combination with cooperative relaying.

[0003] Cooperative multipoint transmission (CoMP) in combination with relaying has the advantage that RNs are fixed network elements or radio stations and therefore one can expect only minor channel variations. Current reference signal design e.g. for common reference signal (CRS), and channel state information reference signals (CSI RS) are designed to support moderate up to high velocity of movement of a network element, e.g. a user equipment, or high fluctuation of the channel performance.

[0004] For advanced cooperative relaying on the feeder links as being investigated in ARTIST4G one can expect from e.g. 3 up to 10 (or even more) relevant channel components (CC), which have to be estimated as well as reported with high accuracy from the RNs to the DeNB. This would allow for very high performance, i.e. for e.g. 4-8 data streams per RN with a modulation and coding scheme (MCS) of 64QAM5/6 corresponding to ideally 10 to 20 bit/s/Hz on the backhaul link. Latest simulation results achieved a mean spectral efficiency of about 14 bit/s/Hz/cell for all RNs of a cooperation area assuming ideal channel knowledge.

[0005] To keep performance losses reasonable low, the CSI accuracy for the channel components should be very high with a normalized mean square error much lower that 0.01 (MSE<<0.01) with respect to the strongest CC. One way to improve CSI estimation accuracy is to provide more orthogonal resources for channel estimation, but this leads to accordingly larger overhead for reference signals, especially for the high number of channel components and under the assumption of high frequency granularity.

[0006] 3GPP LTE uses the CRS for LTE Release 8 UEs and CSI reference signals as defined in LTE Release 10, where the CSI RSs are sparse in time and frequency. Muting allows to avoid some inter cell interference at the expense of higher overhead. In frequency direction only one RS per PRB is provided, which might be too few in case of advance cooperative backhauling.

[0007] One could imagine making use of the relative stable channel conditions by applying some form of CSI delta reporting or according channel tracking solutions, but unfortunately this means already quite some overhead. In case of reporting of a single delta value per physical resource block (PRB) with at least 2 bit per PRB than each report might add up already to 100 (for 50 PRB)*16 (channel components) =1600 bit per report. At the same time there might be fast moving objects like a passing car, which then requires dense reporting in time, e.g. every 5 to 10 ms or even faster giving an overall physical uplink control channel (PUCCH) rate of 1600 every 5 ms=320 kbit/s per RN.

[0008] Another critical condition for delta tracking is an RN placed e.g. on the end of a lamp post. In case of strong wind the RN might easily swing by several cm, which is already in the range of one wavelength for e.g. 2.6 GHz. As well known—depending on the scenario—within one wavelength the channel conditions might change completely bringing simple tracking solutions to its limits. It can be estimated that for mechanical swing frequencies of 10 Hz a reporting every 2 ms to 5 ms will be needed.

SUMMARY OF THE INVENTION

[0009] There may be a need to achieve simultaneously highest channel state information accuracy for a large number of channel components and simultaneously low reporting overhead.

[0010] This need may be met by a method of reporting channel state information in a communication network, a network element, a method of obtaining channel state information, a communication network, a program element and a computer readable medium according to the independent claims. Further embodiments are described in the dependent claims.

[0011] According to an exemplary aspect there is provided a method of reporting channel state information from a network element to a further network element of a communication network, wherein the method comprises decomposing the channel state information into different portions wherein the different portions correspond to channel state information varying on different time scales, and reporting at least one portion of the decomposed channel state information to a further network element.

[0012] In particular, the communication network may be a mobile telecommunication network, e.g. a 3GPP LTE or LTE-A network or a respective evolution or enhanced predecessor of such communication networks. For instance, it may be a mobile communication network adapted to perform cooperative multipoint transmission which may be based on joined precoding. For example, the different portions of the decomposed state information may be reported based on different repetition rates. The term "repetition rate" may particularly denote a parameter which describes the repetitions performed during a given predetermined time period.

[0013] According to an exemplary aspect there is provided a network element for performing channel state information reporting in a communication network, the network element comprising a processing unit and a transmitting unit, wherein the processing unit is adapted to decompose channel state information into different portions wherein the different portions correspond to channel state information varying on